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Synopsis of Research topic

"Study of avian diversity and their correlation with Macroinvertebrates as food in Ujani-Bhigwan reservoir. (M.S.)"

Submitted for

Registration to Ph.D. Degree in Zoology

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Department of Zoology, School of Life Sciences,

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Synopsis of the research topic for registration to Ph.D. in Zoology.

Study of avian diversity and their correlation with Macroinvertebrates as food in Ujani-Bhigwan Reservoir. (M.S.)

Introduction

Birds play an important role in the functioning of world ecosystem; they are important role in human health, economy, tourism and agriculture production. Birds are economically important due their insectivores ability to increases the crop production. (Balen, 1989).

Aquatic invertebrate have important role in the assessment of effect of human activity on water body, they have important role in the freshwater ecosystem as functional group. Benthic macroinvertebrates or benthos, (benthic = bottom) are organisms that live on the bottom of streams and rivers. Wetland are affected more by predation, bioturbation, and waterbird herbivory than by competition. Recent findings in this connection suggest that waterfowl and the increasing population of flamingos are of great importance in structuring shallow lakes. study provides some of the strongest evidence to date that flamingos and other waterbirds (essentially ducks and coots) have a notable influence on benthic invertebrate abundance and community structure in shallow lakes (Rodriguez-perez, 2012). Benthic macroinvertebrates are involved in cycling nutrients and controlling nutrient outflows from ecosystems (Covich et. al, 1999). The representative of benthic fauna lives in close association with bottom substrate where the organic pollutants & chemical contaminants tend to accumulate and where the low oxygen conditions are typically the most severe. Moreover, they are relatively sedentary or slow-moving, and hence it is difficult for these organisms to avoid any kind of exposure to the pollutants and other adverse conditions in their immediate surroundings (Hyland et.al 2005).

Ujani-Bhigwan Reservoir is located near the Pune-Solapur highway, Maharashtra State. It is recently declared as an established IBA area that supports 230 local, migratory visitors and transit avifauna since the year 1980. (Chavan et. al, 2020). Freshwater wetlands are threatened due to eutrophication and pollution, due to crisis of drinking water and low quality water. Waterbirds are important part of the wetland many wetlands support the large number of birds, Ujani-Bhigwan Reservoir also support the large number of local water birds and as well as

migratory bird and waders. Birds can play an important role to stop the eutrophication, Benthic macroinvertebrates also play an important role in the nutrient cycling and food web, the role of birds and benthic micro invertebrate is important area of research. Current investigation is planned with following objectives,

Objectives

1) To assess the abundance status, residential/migratory status, IUCN status, species diversity and evenness of different avian species in Ujani-Bhigwan Reservoir.
2) To identify threats for migratory birds and their conservation in Ujani-Bhigwan Reservoir.
3) To study feeding ecology and food chain of water birds and waders
4) Study the seasonal diversity abundance and role of Macroinveretebrates and benthic invertebrates in the food chain of Birds in selected study area.

Study area

Ujani-Bhigwan Reservoir is located at border of Pune, Ahmednagar, and Solapur. It is famous for a migratory birdS like flamingo, it is a famous tourist spot for birders. it consists of earth fill gravity Dam with concrete sluice gates near village Ujani hence named ujani reservoir. It has having storage capacity 3,140, 000, 000 M^3 in 2,550,000 acres water-spread area. The Dam is constructed on River Bhīma one of the main tributaries of River Krishna forming the Krishna river basin in western Maharashtra. The catchment area for this reservoir is the eastern parts of Western Ghats mainly including parts of district Pune and Ahmednagar of Maharashtra State. It is located on the match point of geographical borders of district Pune, Ahmednagar, and Solapur of M. S. The reservoir was constructed during year 1969 to 1980 under multipurpose needs of water for irrigation, drinking, hydroelectric and industrial use. (Chavan et. al, 2020).

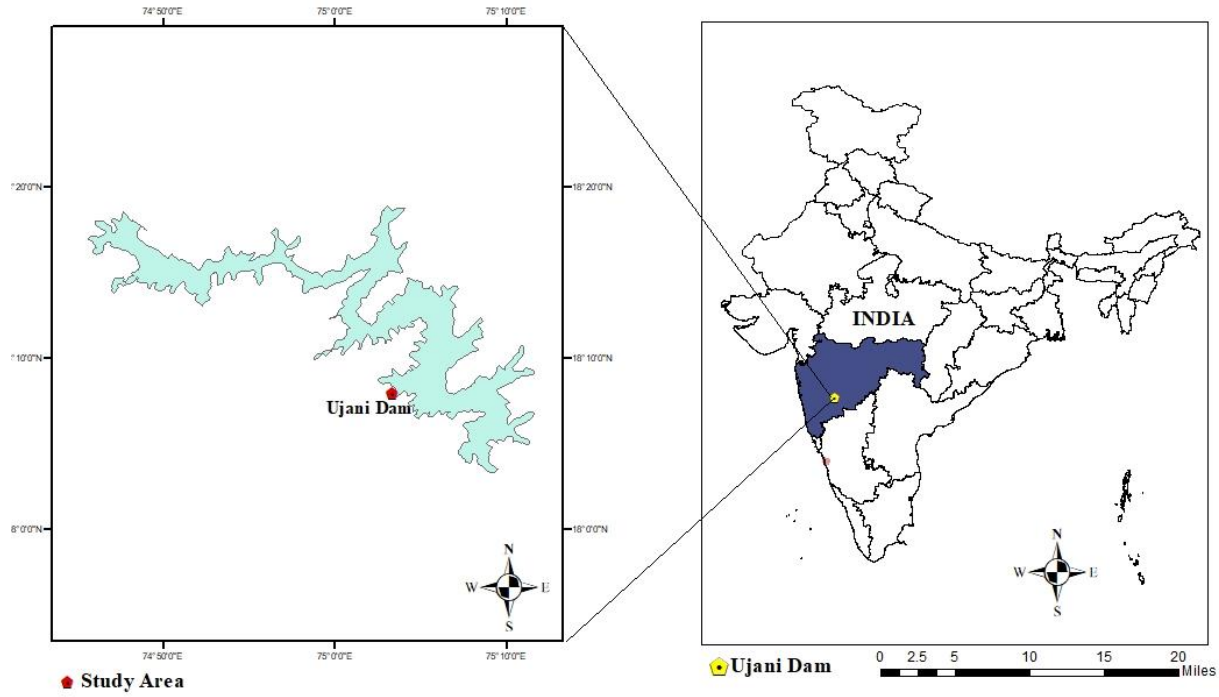

Fig. Study area of Ujani Dam

Review of literature and development in the subject

Adhurya et. al. (2020)

Sagar Adhurya, Suvendu Das and Santanu Ray stated that water birds have important role in the wetland conservation. Waterbirds droppings are important source of nutrient in rivers and lakes; it is important link between aquatic ecosystem and terrestrial ecosystem.

Ashley et. al. (2000)

Ashley et. al studied the relationship between benthic invertebrates and aquatic birds at a newly constructed wetland using an avian enclosure experiment combined with counts of aquatic bird use. The experiment however found no significant effect of predation on invertebrate densities.

Brraich et. al. (2017)

Onkar Singh Brraich and Rajwinder Kaurwhich studied the Nangal wetland located on River Satluj, Punjab They used macroinvertebrate diversity indicator for biological and water quality assessment for wetland. Ten groups of benthic macroinvertebrates were recorded, viz. Ephemeropteras, Plecoptera, Hemiptera, Diptera, Tricoptera, Coleoptera, Araneae, Odonata, Annelida and Gastropoda. The benthic macroinvertebrate density was found to vary in different years indicates that the wetland is moderately polluted that further affects the occurrence of benthic macroinvertebrates.(Brraich & Kaur, 2017)

Basu et al (2018)

Study stated that Benthos are used as indicators of aquatic ecosystem, many species give response to the pollution. Study of Ichamati river by Basu et al (2018) done in two seasons pre-monsoon and post-monsoon, He found that benthos species are dependent on the habitat condition. 23 Macrobenthic species belonging to three phyla, five classes and nine orders were identified. Mollusca were the dominant species and organic carbon and organic matter increases the number of benthic macroinvertebrates.

Umek J et. al. (2010)

the study was done in Lake Mead United States which is major water source to south-western part of country, stated that Benthic resources contributes to the higher level consumer like fishes, Oligocheta and chironomidae dominated the soft sediment and main food for the higher level organisms. stomach content was analysed for the food source of the fishes.

Chawaka et. al. (2018)

For the ecological status of wetland Chawaka et. al. studied the macroinveretbarte and birds in south-western Ethiopia. The most commonly found macroinvertebrate families were Chironomidae and Dytiscidae followed by Coenagrionidae. they found that water depth, dis- solved oxygen saturation and macroinvertebrate abundance were positively correlated with species richness and abundance of wetland dependent birds, whereas hu- man disturbance was negatively correlated with both bird abundance and richness. Wetlands with open water such as Chalalaki, Bulbul and Haro were characterized by a higher species richness and abundance of wetland dependent birds com- pared to wetlands totally covered by vegetation. Species richness and abundance of wetland associated birds appeared to be more or less similar in wetlands with open water and wetlands totally covered by vegetation.

Rodriguez-Perez.et.al.,(2018)

He´ctor Rodrı´guez-Pe´rez and Andy J. Green experimentally prove that there is strong seasonal effect of waterbirds on benthic community in shallow lakes. Waterbirds are important benthic predators in marine and inland aquatic systems. in shallow water He´ctor Rodrı´guez-Pe´rez and Andy J. Green setup a experiment with 2 exclosure and 1 control treatment. The all-birds (A) treatment consisted of 2-cm-mesh nylon netting tied to a square polyvinyl chloride (PVC) frame suspended from 4 iron poles (2 m long, 10 mm diameter) pushed into the pond bottom in each corner. he attached wires from the tops of the poles to the centre of the net to prevent it from touching the water surface. At the sides of the square frame, 20 cm of netting hung vertically down to the water surface to prevent birds from passing underneath. This design allowed fish to enter but prevented entry by ducks, coots, and other birds. The netting did not visibly affect water movement. No algal growth occurred, and shading was ,3% because of the large mesh size. They observed that our study provides some of the strongest evidence to date that flamingos and other water birds (essentially ducks and coots) have a notable influence on benthic invertebrate abundance and community structure in shallow lakes.

Sharmin S. et. al. (2018)

Sharmin, S. et. al. observed the macrobenthic fauna in relation to immunological variables in migratory bird visiting lake at jahangirnagar university, Bangladesh. The correlation between benthic group and environmental parameters was highly divergent. The case of Phylum Mollusca and Annelida showed strong positive correlation with water temperature, water PH, water depth, soil organic carbon and soil organic matter whereas phylum Arthropoda showed negative relation with soil parameters

Zhang et. al. (2016)

Zhang et. al. in the study on Numerical Response of Migratory Shorebirds to Prey Distribution in a Large Temperate Arid Wetland, China. To explore the connections among ecosystem health, prey density, and shorebird populations, they conducted surveys of both the benthic macroinvertebrates and shorebirds in the shorebird habitat of the wetland during the 2011 autumn migration season. The abundance of both shorebirds and benthic macroinvertebrates varied significantly in both space and time. Data showed a clear association between shorebird populations and the density of benthic macroinvertebrates, which explained 53.63% of the variation in shorebird abundance. The prey density was strongly affected by environmental factors.

Zou et. al. (2008)

Zou et. al study the effect of benthos on wetland area and bird, they selected five sites for sampling to test the hypothesis in Gaoqiao and Qishui on the west coast; Fucheng and He'an on the east coast; and Wuli on the south coast. they found that There was no significant difference between spring and autumn on biomass or density of benthos. There was a significant and negative correlation between number of shorebirds and densities of polychaetes on mudflats.

Methodology

Avifaunal diversity study

The photo sampling will be done seasonally between 6.30 to 11.00 hrs. and 16.30 to 18.30 hrs. Birds will be sighted at the study place by walking along the study area. (Chavan et. al.,2015) photo and video will captured with the help of NIKON-P950 or P-1000 model digital camera with autofocus and auto inbuilt zoom, 46 X extra zoom 16.6 Mega Pixel. Identification of bird will be done with the help of Avifaunal field guidebooks (Kazmierczak et. al., 2003; Grimmett et. al., 2011)

Macroinvetebrates

The specimens were collected from water bodies with the help of an aquatic net of mesh size less than 300μm. The large-sized specimens of macroinvertebrate were collected by handpicking. The collection was done randomly during sporadic visits to water bodies. The collected specimens were preserved in 70% ethanol. The specimen vials were labelled with respect to date of collection, locality, name of the collector, etc. (Pande et. al. 2020**,** Chawaka et. al., 2018)

Benthos Sampling will be done with the help of quadrant (15cm length×15cm width×10cm height). All the sediment samples were washed separately through a 300μm nylon mesh by using water and then transferred to polythene bags and preserved in 5% formaldehyde containing Rose Bengal stain. In the laboratory, all the sediment samples were again washed on a 300μm sieve. All the fauna were sorted and preserved in plastic vials containing 5% formaldehyde. The fauna was enumerated and identified up to the group level under the stereo microscope. (Basu et.al. 2018).

Expected outcomes

With the help of this study it will be possible identify local and migratory bird, their conservational status, threats for migratory bird in Ujani-Bhigwan Reservoir. Many migratory water birds migrates to Ujani-Bhigwan Reservoir their feeding ecology will be determined. Fishes feed on macroinvertebrates and bird and other organism feeds on fishes that directly correlation of macroinvertebrates and benthos will be identified during this study. The role of macroinvertebrates as food may be identified. Therefore it will be a study of avian diversity and macroinvertebrates correlation.

Importance of study

International status

The loss and degradation of wetlands worldwide has adversely affected waterbirds, which depend on wetland habitats. Over 50% of wetlands in the world have been lost in the past century, and the remaining wetlands have been degraded to different degrees because of the adverse influence of human activities.

Birds are an extremely diverse group of animals, of that the colonial birds are good bioindicators; colonial birds are sensitive to environmental changes (Kushlan 1993). Birds may respond quickly to any change in habitat and climatic conditions (Fuller et al. 1995).

Macroinvertebrate assemblages are good indicators of localized conditions. Because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life, they are particularly well-suited for assessing site-specific impacts. (Barbour et.al. 1999). Pelagic, terrestrial as well as benthic community play important roles in the food web. Research indicates a strong reliance of the fish community on benthic resources with an intermediate consumer (Umek et. al. 2011). Research examining food web interactions in these ecosystems however has primarily focused on the flow of energy through the pelagic habitat and has only recently examined the flow of energy to higher trophic levels like birds in freshwater ecosystem (Vadeboncoeur et al. 2002, Vander Zanden et al. 2005). Therefore the present has relevance with the research going on in this line abroad and it is unique for the benthic diversity and avian dependence in freshwater ecosystem.

National status

In India 12% (165 species) of the 1395 species occurring in the Indian subcontinent (ENVIS-BNHS). The migratory birds are seasonal guests with positive impacts**;** require nesting places and sufficient food for successful breeding. There is an accelerated habitat loss during last decade, including decreased area under water bodies, wetlands, natural grasslands and forests have proved to be major impediments for them. Overexploitation, unsustainable use of natural resource, population explosion along with increased weather variability and climate change has resulted in loss of biodiversity. These factors have also adversely impacted the entire life cycle and survival of migratory birds. New approaches are needed to prevent the ill-effects and altered migration patterns of birds.

Benthic macroinvertebrate communities are indicators of aquatic ecosystem health as many species are responsive to pollution and abrupt changes in their surroundings (Basu et. al 2018).Examination of parameters like richness, diversity, abundance, evenness and community composition are essential to determine the natural or anthropogenic changes with time (Mittermeier & Mittermeier 1997; Dudgeon et al. 2006; Srivastava 2007; Strayer & Dudgeon 2010; Jun et al. 2016). At Ujani reservoir the anthropogenic pressure of agricultural practice, pesticide use, sand dredging, transport across water body are increasing. The water input in the reservoir is literally drainages from upstream cities like Pune through Mula-Mutha tributeries of Bhima River, hence this study has its national importance.

Significance of study

Ujani reservoir is large manmade wetland, many birds migrates to Ujani reservoir, the information of migratory birds, importance of migratory bird, threats for migratory birds in relation to tourism, local birds; their feeding ecology will be understand clearly during this study. The role of macroinveretebrates in the freshwater ecosystem in India is not much studied; present investigation provides an account of the diversity of macroinvertebrates of Ujani reservoir which is located on Bhima River, Maharshtra. The seasonal study will clear the changes in ujani reservoir. In wetland ecosystem Macroinveretbartes are important aspects as correlation to birds. The impact and relation of macroinvertebrates will be investigated. The coastal and backwater area of this waterbody is remarkable assemblage of avifauna that feed on macroinvertebrates mainly. This will be the main focus of selected research plan.

Tentative timetable

In the first year of the Ph.D. mostly course work and literature review will be carried out along with survey for marking sampling stations at field site of Ujani reservoir. Sampling of the freshwater invertebrates and benthos will be carried out in all three years for seasonal data, along with identification of bird assembled there with emphasis on bird behaviour and bird feeding patterns. Analysis of invertebrates and other samples will be carried out from second half of the first year. Taxonomic studies of the invertebrate and benthos will (Basu et.al 2018, Pande GS.2020, Ramakrishna et.al. (2007), Thorp et.al.2011,) are carried out by phase contrast microscope and mic-rocamera attachment. Data analysis of will be carried out in the final year of research. Along with thesis writing for the final submission of Ph.D. thesis to the university.

Tasks	**Year**					
	Ist		**IInd**		**IIIrd**	
	Month					
	6	**12**	**18**	**24**	**30**	**36**
Course work and literature review						
Fields Sampling and Survey						
Sample Analysis & Processing						
Data Analysis & Processing						
Thesis Writing, publication of data & Submission						

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